What is claimed is:

1. An apparatus for measuring the effective capacitance across a biosensor cell having a first conductor connection and a second conductor connection, the biosensor cell configured to receive a sample having a volume, said apparatus comprising:

a sine wave generator having an output for coupling to the first conductor connection of the biosensor cell, said sine wave generator producing an AC signal;

a current-to-voltage (I/V) converter having an input for coupling to the second conductor connection of the biosensor cell and further having an output;

a phase shifter having an input coupled to the output of said I/V converter and further having an output;

a square wave generator producing a square wave synchronous with said AC signal;

a synchronous demodulator having an output, a first input coupled to said phase shifter, and a second input coupled to said square wave generator; and

a low pass filter (LPF) having an input coupled to the output of said synchronous demodulator, said LPF producing a signal at an output proportional to an effective capacitance across the biosensor cell.


2. The apparatus of claim 1, further comprising:

a DC voltage source coupled to the first conductor connection of the biosensor cell, said DC voltage source adding a DC component to said first conductor.

3. The apparatus of claim 2, wherein said phase shifter shifts the phase of a signal out of said I/V converter and removes said DC component from said signal out of said I/V converter.

4. The apparatus of claim 1, further comprising:

an analog-to-digital (A/D) converter having an analog input coupled to the output of said LPF and further having a digital output, said A/D converter converting said signal proportional to the effective capacitance across the biosensor cell from analog to digital.

5. The apparatus of claim 4, further comprising:

a processor coupled to the digital output of said A/D converter to process said digital signal proportional to the effective capacitance across the biosensor cell to derive the effective capacitance across the biosensor cell.

6. The apparatus of claim 5, said processor further deriving the volume of the sample based on the effective capacitance across the biosensor cell.

7. The apparatus of claim 1, wherein said sine wave generator generates a synthesized sine wave.

8. The apparatus of claim 7, wherein said synthesized sine wave is a stair type sine wave.

9. A biosensor for measuring components within a sample, said biosensor comprising:

a biosensor cell having a first conductor connection and a second conductor connection, said biosensor cell configured to receive the sample;

a sine wave generator coupled to the first conductor connection of said biosensor cell, said sine wave generator producing an AC signal having a determined frequency;

a current-to-voltage (I/V) converter having an input coupled to the second conductor connection of said biosensor cell and further having an output;

a phase shifter having an input coupled to the output of said I/V converter and further having an output;

a square wave generator producing a square wave synchronous with said AC signal;

a synchronous demodulator having an output, a first input coupled to the output of said phase shifter, and a second input coupled to said square wave generator; and

a low pass filter (LPF) having an input coupled to the output of said synchronous demodulator, said LPF producing a signal at an output proportional to an effective capacitance across said biosensor cell.

10. The biosensor of claim 9, further comprising:

an analog-to-digital (A/D) converter having an analog input coupled to the output of said LPF and further having a digital output, said A/D converter converting said signal proportional to the effective capacitance across the biosensor cell from analog to digital.

11. The biosensor of claim 10, further comprising:

a processor coupled to the digital output of said A/D converter to process said digital signal proportional to the effective capacitance across the biosensor cell to derive the volume of the sample.

12. The biosensor of claim 9, further comprising:

a DC voltage source coupled to the first conductor of said biosensor cell, said DC voltage source adding a DC component to the apparatus.

13. The biosensor of claim 12, wherein said phase shifter shifts the phase of a signal out of said I/V converter and removes said DC component.

14. The biosensor of claim 12, further comprising:

an analog-to-digital (A/D) converter having a digital output and an analog input, said analog input coupled to the output of the I/V converter through a first switch and coupled to the output of said LPF through a second switch, only one of said switches being closed at a time.

15. The biosensor of claim 14, further comprising:

a filter coupled between the I/V converter and the A/D converter in a path containing said first switch to remove an AC component from said path.

16. The biosensor of claim 14, further comprising:

a processor coupled to the digital output of said A/D converter to process said digital signal proportional to the effective capacitance across the biosensor cell when said second switch is closed and to process the output of said I/V converter to determine if the sample is of a specific type when said first switch is closed.

17. The biosensor of claim 14, wherein the sample is blood and the component is glucose, and wherein said processor further calculates the glucose level for the sample of blood using the derived volume.

18. The biosensor of claim 17, wherein said DC voltage source is configured to apply a first voltage of a first polarity to said biosensor cell during a first period and to apply a second DC voltage of a second polarity to said biosensor cell during a second period.

19. The biosensor of claim 18, further comprising:

a processor coupled to the digital output of said A/D converter to process said digital signal proportional to the effective capacitance across the biosensor cell when said second switch is closed, to process the output of said I/V converter when said first switch is closed to determine a first current through said biosensor cell during said first period and a second current through said biosensor cell during said second period, and determine a glucose level

for said sample of blood based on said effective capacitance, said first current, and said second current.

20. A method for measuring the effective capacitance across a biosensor cell having a first conductor connection and a second conductor connection, the biosensor cell configured for use in a biosensor to receive a sample having a volume, said method comprising the steps of:

applying a sine wave having a determined frequency to the first conductor connection of the biosensor cell to produce an AC signal;

shifting the phase of said AC signal;

generating a square wave synchronous with said sine wave;

demodulating said AC signal with said square wave to produce a demodulated signal; and

filtering said demodulated signal to produce a signal proportional to the effective capacitance across the biosensor cell.

21. The method of claim 20, further comprising the steps of:

applying a DC voltage to the first conductor connection of the biosensor cell, said DC voltage introducing a DC component; and

removing said DC component prior to demodulating said AC signal.

22. The method of claim 20, further comprising the step of:

converting said signal proportional to the effective capacitance of the biosensor cell from analog to digital.

23. The method of claim 20, further comprising the step of:

processing said signal proportional to the effective capacitance of the biosensor cell to determine the volume of the sample received by the biosensor cell.

24. The method of claim 20, further comprising the step of:

calibrating the biosensor.

25. The method of claim 24, wherein said calibrating step comprises the steps of:

obtaining a first signal average for said digital signal proportional to the effective capacitance of the biosensor cell when the sample is not received by the biosensor cell;

obtaining a second signal average when a known capacitance is coupled across the biosensor cell;

calculating a capacitance conversion slope by dividing the value of said reference capacitor by the difference between the first signal average and the second signal average; and

storing said capacitance conversion slope for correcting the signal proportional to the capacitance across the biosensor cell.

26. A glucose measurement method for use with a biosensor, said biosensor configured to receive a sample having a volume, said method comprising the steps of:

determining the volume of the sample through synchronous demodulation when the sample is received; and

determining a glucose measurement for the sample if the volume is greater than a first level based on the determined volume of the sample.

27. The method of claim 26, further comprising the step of:

detecting whether the sample is of a specific type; and

storing the glucose measurement if the sample is said specific type.

28. A method for measuring glucose levels in a sample partially filling a biosensor cell, the biosensor cell having a filled effective capacitance, said method comprising the steps of:

determining a partially filled effective capacitance for the sample;

determining a first current level passing through the biosensor cell during a first pulse;

determining a second current level passing through the biosensor cell during a steady state portion of a second pulse;

multiplying said first current level by the ratio of the filled effective capacitance to said partially filled effective capacitance to generate a first compensated current level;

multiplying said second current level by the ratio of the filled effective capacitance to said partially filled effective capacitance to generate a second compensated current level; and

calculating a glucose level for the partially filled sample based on said first and second compensated current levels.